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*Corresponding author: Eugene M. Buthelezi, Department of Economic and Finance, University of KwaZulu-Natal, KwaZulu-Natal, King Edward Ave, Scottsville, Pietermaritzburg 3201, South Africa E-mail: msizi1106@gmail.com

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DEVELOPMENT ECONOMICS | REVIEW ARTICLE

The dynamic relationship between government debt, fiscal consolidation, and economic growth in South Africa: A threshold analysis

Eugene M. Buthelezi¹ and Phocenah Nyatanga^{1*}

Abstract: This paper investigates the threshold impact of government debt on economic growth in the presence of fiscal consolidation in South Africa from 1979 to 2022. The autoregressive threshold regime (TAR) model and two-stage least squares (2SLS) are used. The contribution of the paper is on the estimation of the threshold of government debt using the first difference, dummy variables, and the TAR in the presence of fiscal consolidation in South Africa. The TAR provides evidence with the consideration of fiscal consolidation, there is evidence of the U-shape impact of domestic government debt on gross domestic product per person. At a high threshold, there is evidence of an S-shape impact on gross domestic product per person when there is a range threshold. Overall high domestic government debt harms gross product per person and results in fiscal consolidation not being able to stimulate gross domestic product per person. It is recommended for fiscal authorities to not use fiscal consolidation when the domestic government debt is above 60% in South Africa.

Subjects: Economic Psychology; Political Economy; Economics

Keywords: fiscal consolidation; domestic government debt; cyclically adjusted primary balance (CAPB)

JEL Classification: F20; F21; F30; F34; E62; O40

1. Introduction

Both theoretically and empirically, it has been argued that using government debt to stimulate economic growth in emerging economies like South Africa is important (Benayed et al., 2015; Cecchetti et al., 2011; Legrenzi & Milas, 2013; Kumar & Woo, 2013; Reinhart & Rogoff, 2010; Reinhart et al., 2012). The argument is that government debt in developing nations with limited resources will stimulate economic growth (2015. Some nations periodically use government debt to boost economic development a result. The debate on cyclically adjusted primary balance (CAPB) has gained interest over the years in the effort to find fiscal consolidation. However, no consensus on what threshold to be used can be attributed to fiscal consolidation episodes including Alesina & Ardagna (2010), Alesina and Perotti (1995), Alesina et al. (2017, 2019), Tovar Jalles (2017), Woldu (2020). Woo et al. (2013), Wu et al. (2010), Xiang et al. (2021), Yang et al. (2015) amongst others. The thinking around fiscal consolidation is that government expenditure cuts and tax increases will result in a fall in government debt. This is because forward-looking economic agents will anticipate





© 2023 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group. This is an Open Access article distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited. The terms on which this article has been published allow the posting of the Accepted Manuscript in a repository by the author(s) or with their consent. a reduction in tax and interest rates. This will increase permanent income, crowd in investment, increase economic activities, and higher tax collection that can be used to reduce government debt (Alesina & Ardagna, 2010; Alesina & Perotti, 1995; Alesina et al., 2017, 2019). At a policy level in South Africa, fiscal authorities have made policy interventions to curb government debt. These interventions include the Public Finance Management Act of 1999 (PFMA), which advocates expenditure control. Regarding government debt, SA adopted the Southern African Development Community (SADC) (2006) Protocol on Finance and Investment (PFI), which stipulates that all member countries should have a rate of government debt share to GDP that is equal to or below 60% (Buthelezi & Nyatanga, 2018; SADC, 2006). In 2012, the government introduced the expenditure ceiling to constrain high government debt, as such a government committed to limiting real expenditure growth to an average of 2.9% per year (BR, 2012). In 2013, the government introduced to R1.5 billion between 2013 and 2014 (BR, 2013).

In 2014, the Financial and Fiscal Commission (FFC) recommended more fiscal consolidation stances to restore the fiscal position and reduce government debt (BR, 2014). The FFC recommendation outlined that Fiscal consolidation can no longer be postponed. Ensuring continued progress towards a better life obliges the government to safeguard public finances by acting within fiscal limits that can be sustained over the long term. To do otherwise would risk exposing the country to a debt trap, with damaging consequences for development for many years to come. (MTBPS, 2014) The Fiscal Responsibility Bill (FRB) was tabled for discussion in the parliament of SA in 2018. The bill seeks to introduce government expenditure cuts, limit new government borrowing, maintain an expenditure ceiling, and eliminate wasteful expenditure (FRB, 2018). In the year 2019, the International Monterey Fund (IMF), Standard and Poor's, Moody's, and Fitch stressed that SA needs to implement a credible fiscal strategy and fiscal consolidation to contain the rise in government debt. This recommendation came with concern that the country is faced with high government debt and that there is policy uncertainty (IMF, 2020). South African domestic government debt has reflected upwards swings as well as downward swings from 1979 to 2022. The domestic government debt before democracy in 1994 is characterized by the variation cycle, which ranges between 29% and 41.80% (SARB, 2022). From 1979 to 1994, the mean value of domestic government debt was 32.03%. After 1994, domestic government debt increased until it reached a rate of 44.66% in 1999. Domestic government debt starts to follow a downward trend until it reaches the minimum value of 21.99%. However, after the domestic government debt increased drastically, it surpassed the previous cycle rate of 41.8% in 1994 and was at a rate of 42.22% in 2015 (SARB, 2022). Domestic government debt continues to increase until it reaches a rate of 71.72% in 2021 (SARB, 2022). This rate of 71.72% is the rate that is above the 60% threshold that is advocated by SADC countries of which South Africa is a member (Buthelezi & Nyatanga, 2018).

South Africa was selected for investigation because fiscal authorities have shown interest in the adoption of fiscal consolidation in the effort to reduce government debt; however, there is limited research on the topic (BR, 2015; MTBPS, 2014; MTBPS, 2017). The problem that has been identified is that the domestic government debt is now above the threshold of 60% which is deemed to be stable in SADC countries. South Africa is one of the strongest countries in SADC, and for South Africa to have a rate of domestic government debt that is above 60% is concerning (Buthelezi & Nyatanga, 2018; SADC, 2006). However, what is true for the regional grouping may not necessarily be true for one country. In this regard, it is critical to investigate the threshold impact of domestic government debt on economic growth, particularly in the presence of fiscal consolidation. There is no policy in South Africa as to what the cap of government debt is. On the other hand, there is no consensus among scholars on the impact of fiscal consolidation on government debt. Case in point (Afonso et al., 2022; Alesina & Perotti, 1995; Blanchard, 1990; Brady & Magazzino, 2018; David et al., 2022; Marattin et al., 2022) among others found that fiscal consolidation reduces government debt. While Müller (2014), Deskar-Škrbić and Milutinović (2021), and Georgantas et al., 2023) among others outline that fiscal consolidation increases government debt; therefore, it is self-defeating. As such, it is critical to have a country-based

investigation to find out the impact of fiscal consolidation. In an effort to find the solution to the problem of high government debt, scholars like Agnello and Sousa (2019) and Nunes (2019) have investigated the success of fiscal consolidation (the after-effect of fiscal consolidation) on government debt. Hansen (2000), Eyraud and Weber (2013), Gechert and Rannenberg (2015), Auerbach and Gorodnichenko (2017), Olaoye and Olomola (2022), and Marattin et al. (2022) among others have looked at the nonlinearity and the long and short-run effect of fiscal consolidation on government debt. There has been a gap in the literature looking at the aspect of the threshold impact of government debt and fiscal consolidation in the presence of fiscal consolidation. Moreover, the point of departure or contribution is on the estimation of the threshold of government debt using the first difference, dummy variables, and the TAR in the presence of fiscal consolidation in South Africa. With this inclusion of fiscal consolidation, most of the studies look at it on an individual based and not with government debt threshold as well as economic growth.

The paper is significant because it uses Buthelezi and Nyatanga's (2023b) data which consists of time-varying elasticity CAPB to capture fiscal consolidation. Buthelezi and Nyatanga (2023b) note that time-varying elasticity CAPB is accounted for, there is a 56.26% variation in the CAPB with time-varying elasticity, and there is a 2.36% variation in the CAPB of the IMF data. As such the time-varying elasticity CAPB better capture fiscal consolidation. The significance of the study is to investigate the threshold impact of domestic government debt on economic growth, particularly in the presence of fiscal consolidation, in South Africa. The paper aims to provide insight into the relationship between government debt and economic growth in the country, which has become a concern due to the high level of domestic government debt that is above the threshold of 60% deemed to be stable in SADC countries. The paper also aims to contribute to the existing literature on the impact of fiscal consolidation on government debt, as there is no consensus among scholars. By conducting a country-based investigation, the study seeks to shed light on the impact of fiscal consolidation in South Africa and how it affects government debt. The findings of the study could be useful for policymakers in South Africa who are interested in adopting fiscal consolidation measures to reduce government debt. The study could provide insights into the threshold impact of government debt and fiscal consolidation on economic growth, which could inform policy decisions on government debt management.

Given the background, the key economic question of this paper is what is the threshold impact of domestic government debt on gross domestic product per person in the presence of fiscal consolidation, from 1979 to 2022? The paper employs the autoregressive threshold regime (TAR) model and two-stage least squares (2SLS) to estimate the threshold of government debt using first difference, dummy variables, and TAR in the context of fiscal consolidation. The paper's main contribution is the investigation of the threshold impact of government debt on economic growth in South Africa and how it is affected by fiscal consolidation measures. The study finds that with the consideration of fiscal consolidation, domestic government debt has a U-shaped impact on gross domestic product (GDP) per capita. When the threshold is high, there is evidence of an S-shape impact on GDP per capita, indicating that high domestic government debt hinders economic growth, and fiscal consolidation fails to stimulate GDP per capita. Based on the paper's findings, it is recommended that fiscal authorities in South Africa refrain from implementing fiscal consolidation measures when domestic government debt exceeds 60%. This research paper adds to the existing literature on the impact of government debt on economic growth and fiscal consolidation and could be useful for policymakers in South Africa.

The rest of the paper has the following. First, section 2 outlines a literature review theory of government debt, and empirical work on government debt, economic growth, and fiscal consolidation threshold. Second, section 3 discusses the methodology. Fourth, section 4 discusses the empirical results. Finally, section 5 outlines the conclusion of the paper.

2. Literature view

2.1. Theoretically review of fiscal consolidation

Theoretically, the classical school of thought advocates that fiscal consolidation based on tax increase results in less production, as tax increases the cost of doing business. On the other hand, when fiscal consolidation is based on a government expenditure cut, this will crowd in investments. As such, there is less room for government intervention in the economy (Mankiw, 2019). Given the positive and negative impacts that may come with fiscal consolidation, the net effect depends on the size of fiscal consolidation (Alesina & Ardagna, 2013). The traditional Keynesian with sticky nominal wages and prices advocates that there are detrimental effects on economic growth which are induced by fiscal consolidation as it limits the government to spend on economic activities that can boost economic growth. The traditional Keynesian proposed the use of the opposite instrument of fiscal consolidation (Mankiw, 2019). The Ricardian Equivalence theorem counter auger the proposal of the standard Keynesian school, as it argues that economic agents are forward-looking, meaning; an increase in government expenditure financed by debt triggers an expectation of higher taxes in the future. As a result, economic agents in the present time will spend less and save more in anticipation of future tax increases that they will need to pay to settle the debt. In such a situation, increasing government expenditure through debt financing will not trigger economic growth, as demand will remain unchanged (Mankiw, 2019). The new Keynesian points out that fiscal consolidation has a positive effect on economic growth. The new Keynesian advocated that if the Ricardian Equivalence concept of forward-looking is accepted. Therefore, government expenditure cuts will lead to an agent's expectation of the reduction of tax in the future. This will increase the agent's permanent income because of tax reduction; therefore, agents will spend, and economic growth will increase. As such the economy may have a greater return to reduce government debt (Alesina & Ardagna, 2013). The government budget constraint theory outlines that the government's spending is limited by its ability to raise revenue. The theory assumes that the government has a limited number of resources and can only spend what it can afford. Therefore, if the government wants to increase spending, it must find ways to raise revenue, such as through taxes or borrowing (Buthelezi, 2023a; Mankiw, 2019).

2.2. Theoretical review of growth

The Harrod-Domar model is an economic growth model which stresses that economic growth is achieved or depends on the level of savings and capital-output ratio within the economy (Cypher & Dietz, 2008). Harrod-Domar model is given by $\Delta Y = \frac{S}{I - \delta K}$, where S is savings, I is investment, δ is depreciation, K is capital and ΔY denotes the change in economic growth or income. The Solow growth model provides the dynamic view of how savings, investment and population affect economic growth reflected by $Y_t = F(K_t, L_t * E) = A(K_t)^{\alpha}(L_t)^{1-\alpha}$, where Y economic growth, L is labor, K denotes capital, A indicates technological progress and E stands for efficiency of labour which indicates public knowledge about production methods; which is triggered by the improvement in technology denoted byA. The Solow growth model is dynamic, and this is denoted by a subscript, t in each variable of the model. The exponential subscripts of $1 - \alpha$ is the share of output paid to labour and α is the share of output paid to capital (Mankiw, 2014, 2019). The endogenous growth theory bridges the gap of the Solow growth model which assumes that technology is external in explaining economic growth (Roberta Capello, 2010). The endogenous growth model is expressed by Y = AK, where A is a positive constant that reflects the level of technology. It also indicates a constant measure of the volume of output produced for each unit of capital. The subscript K is capital stock, however, unlike in the Solow model where capital K indicated only, equipment and fixed or physical capital (Mankiw, 2014, 2019).

2.3. Empirical literature threshold government debt

The panel of 59 developing and 24 advanced investigations by Schclarek (2004) suggest that higher public debt levels are not necessarily associated with lower GDP growth rates. Pattillo et al. (2002) investigated external debt and growth in 93 developing economies. They the

system Generalized Method of Moments (GMM) and found evidence that government debt of 35% to 40% harms economic growth. Similarly, the GMM model was used by Reinhart and Rogoff (2010), who concluded thresholds of 90% government debt share of GDP, economic growth on average falls by 1%. The methodology of Pattillo et al. (2002) and Reinhart and Rogoff (2010) by Kumar and Woo (2013) note 10% increase in the initial debt-to-GDP ratio is associated with a decline in per capita GDP growth of around 0.2% to 0.3% per year. Pattillo and Ricci (2011) suggested that the average impact of debt becomes negative when in the range between 35% and 40% of GDP. Cecchetti et al. (2011), investigated the real effects of debt in 18 OECD countries from 1980 to 2010. They found that corporate debt goes beyond 90% of GDP, 85% of government debt, and 56% of household debt resulting in a detrimental effect on economic growth. Reinhart et al. (2012) investigated external debt and growth from 1870 to 2010. The authors used trend analysis and descriptive statistics. It was found that public debt overhang episodes were evident in advanced economies since the early 1800s. Public debt to GDP levels exceeding the threshold of 90% for at least 5 years was found to have a significant detrimental effect on economic growth.

Presbitero (2012) outlines that a 1% increase in government debt leads to a fall in economic growth of 0.008%. On the same line, Kumar and Woo (2013) used 38 advanced and emerging countries from 1970 to 2007 and also find an inverse relationship between initial debt and subsequent growth, controlling for other determinants of growth. The dynamic threshold model (DTM) was utilized by Baum et al. (2013), to investigate the impact of government debt in 12 Euro-area. They noted evidence that government debt share to the growth of domestic product reaches 67% and 95%, which triggers detrimental effects on economic growth. The negative impact of the interest paid kicks in when public debt share to gross domestic product is above the 70% threshold. In State-Varying Thresholds, Legrenzi and Milas (2013) note that the debt threshold for adjustment is estimated at 69% for Greece, 49% for Ireland, 47% for Portugal, and 43% for Spain. These rates reflect the effective rate of government debt accumulation in the respective countries for the fiscal policy authority to consider fiscal consolidation in the effort to stabilize government debt. In a smooth transition autoregressive (LSTAR) of Naraidoo and Raputsoane (2015), there is effective in reducing government debt when it is not beyond the threshold value of 56%. On the other hand, this fiscal consolidation occurs at a higher debt-to-GDP ratio which needs to be relaxed. Benayed et al. (2015) investigated the threshold effect of public debt in 10 selected African countries from 1981 to 2010. The economic variables used were investing, public debt, investment, and GDP amongst others. It was found that a public debt lower than 47.31% of GDP is positively associated with a domestic investment in many African economies. However, the authors are silent on the use of fiscal consolidation.

The Fixed Effects (FE) model of 12 European countries by Checherita-Westphal and Rother (2012) provided that there non-linear inverted U-shaped relationship between public debt ratios and economic growth rates. The turning point is at 90% of government debt, beyond this point government debt-to-GDP ratio is a negative impact on long-term growth. Afonso and Jalles (2013) note that public debt of 10% causes a decrease in economic growth by 0.2%, for countries with debt above 90% and below 30% of GDP. Megersa (2015) found it to be an inverse U-shape. This result reflected that the extreme point or threshold is found at 90% of government gross debt. On the other hand, 25.26% of the observations lie to the left of the extreme point and the rest of the observations 74.74% lie to the right of the extreme point (2015. The recommendation is that this threshold should be adopted by the fiscal authority as the public debt limit and control. Fiscal consolidation was not recommended as the policy for reducing public debt as it was not accounted for in the model. The panel threshold regression (PTR) of Khanfir (2019), when investigating the threshold effect of public debt on economic growth in North African countries, showed that public debt lower than 42.8% of GDP is positively affected by economic growth. They recommended that the adoption of fiscal consolidation requires an appropriate mix of revenue and expenditure measures to ensure that adequate resources are devoted to supporting inclusive growth and

reducing public debt. Liu and Lyu's (2021) threshold regression model revealed a threshold of 130%. The dynamic effect of the threshold of government debt indicates the relationship between the ratio of public debt to GDP and economic growth appears graphically as an inverted U shape. Asymmetric effects of public debt on economic growth in South Africa from 1980 to 2018 were undertaken by (Makhoba, Kaseeram et al. (2021). They found that if public debt rises by 1%, the economy will expand by 0.17% during the low-debt regime. They note an inverted U-shape relationship which implies a significant positive influence of public debt on economic growth during the low-debt regime and a negative influence during a high-debt regime. They were silent on the aspect that is related to fiscal consolidation which probes a gap to be investigated.

2.4. Fiscal consolidation

Blanchard (1990) outlines that a low government debt fiscal consolidation is successful. However, in a deep recession fiscal consolidation is detrimental to government debt. Giavazzi and Pagano (1995), IMF (2010), Afonso (2010), and Alesina and Ardagna (2010), among others, found that fiscal consolidation reduces government debt and stimulates economic growth. Swanepoel and Schoeman's (2003) countercyclical fiscal policy in South Africa analysis suggested that fiscal consolidation implementation in a high level of government debt will result in a 0.4% fall in government debt. Firstly, if government debt is deemed low, primary balance does not react. Second, high level of debt with a higher risk of default, sovereigns will embark on fiscal consolidation. Thirdly, at a high level of government debt, fiscal consolidation is not supportive of reducing government debt.

Eyraud and Weber (2013) give findings that a fiscal tightening of 1% at a high level of a debt-to-GDP ratio results in an initial rise of the debt-to-GDP ratio by 1 percentage point. Lodge and Rodríguez-Vives (2013) found that fiscal consolidation takes a long time to have an effect when initial public debt is high. Calitz et al. (2014)provide evidence that there were substantial increases in government debt in South Africa between 1974 to 1978 and 1985 to 1995 and discretionary fiscal decisions from 2007 to 2010 pose a serious threat to fiscal sustainability. Müller (2014) argues that fiscal consolidation is self-defeating because fiscal multipliers can be large during financial crises and at a high level of government debt. Monastiriotis (2014) notes that fiscal consolidation in response to the Eurozone debt crisis has led to an unprecedented recession.

vGechert and Rannenberg (2015) note that if fiscal consolidation was not adopted, the Greek economy would have entered a prolonged period of stagnation, rather than a depression in 2009. Baharumshah et al. (2016) found that there is fiscal synchronization in South Africa's fiscal consolidation at a high level of government debt that can be effective if undertaken with both government expenditure cuts and tax increases. Chen (2016) outlined that fiscal consolidation is effective in reducing government at a high level. Gechert et al. (2016) found that spending multipliers significantly exceed tax multipliers by about 0.3 in normal times and even more so in recession regimes. The authors concluded that fiscal consolidation should take place during the recovery and should be primarily tax-based. Jordà and Taylor (2016) found that a 1% of fiscal consolidation translates into a loss of 3.5% of real GDP over 5 years when implemented in a slump, rather than just 1.8% in a boom. Burger and Jimmy (2006) provide evidence that there 2 regimes of government debt with a mean of 27.4% and a value of 67% with a transition probability of 0.925% as well as 75% respectively. The fiscal consolidation policy of government expenditure cut reduces government debt. Auerbach and Gorodnichenko (2017) note that fiscal consolidation of the government expenditure cut was found to result in a 2.80% fall in the government debt in the boom period. Heimberger (2017) notes that the link between cumulative real GDP growth and fiscal consolidation measures points to a strong negative association with deep economic crises. Brady and Magazzino (2018) note that in different regimes of high government debt fiscal rules, can be successful in the event of a build-up in public debt. Olaoye and Olomola (2022) analyzed the public debt structure of sub-Saharan Africa's five biggest economies including South Africa. The

Markov-Switching model was used, and it was found that the first regime of South Africa had 31.43% and 45.71% in the second regime with the expected duration of 13 and 10 years in the respective regime. However, they were silent on the use of fiscal consolidation to stabilize the debt. The transitioning from state 1 to 1 and 2 to 2 probabilities are at least 0.92 and 0.93 respectively in all five countries. Buthelezi (2023a) investigated macroeconomic uncertainty on economic growth in the presence of fiscal consolidation in South Africa using the time-varying parameter vector autoregression (TVP-VAR) from 1994 to 2022. It was found the macroeconomic uncertainty in the representee of fiscal consolidation has a negative impact on economic growth. Buthelezi and Nyatanga (2023a) investigated the threshold of cyclically adjusted primary balance (CAPB) that can be attributed to fiscal consolidation in South Africa using the threshold autoregressive regime (TAR) from 1979 to 2022. It was found that the threshold of -1.28168%, 1.9182%, and 1.9270% for the CAPB of total government revenue increase, government expenditure cut, and the CAPB as a sum of both revenue and expenditure, respectively, can be attributed to fiscal consolidation episodes. Buthelezi (2023b) investigated the impact of economic policy uncertainty (EPU) and fiscal consolidation on government debt share to GDP and GDP in BRICS countries from 2009 to 2022. Using the autorearessive distributed lag (ARDL) model it was found that fiscal consolidation has a significant impact on reducing government debt share to GDP in the long run. Buthelezi (2023c) examined the impact of government expenditure on economic growth in different states in South Africa. Using the VEC and Markov-switching dynamic regression with the data from 1994 to 2021. It was found that lower economic state, government expenditure reduces economic growth by 0.009%. it was noted that there is significant impact of government expenditure both in the short and the long run.

3. Methodology

This paper uses quantitative analysis to investigate the question of interest, and yearly time-series data from South Africa from 1979 to 2022 are used. The economic variables that are used in this paper are reflected in Table 1.

The data of tvp_elstcy_CAPB_tgr, tvp_elstcy_CAPB_g, and tvp_elstcy_CAPB is sourced from Buthelezi and Nyatanga (2023). These are the data of Buthelezi and Nyatanga (2023) we developed in the paper to improve the methodology of the International Monetary Fund (IMF) of calculating CAPB to proxy fiscal consolidation with contact elasticity to time-varying elasticity. The IMF calculation is reflected in Equation 1.

Table 1. Economic variables		
Economic variables	Description	Sourced
GDP	Gross domestic product	IMF (2020)
AOLR	Average output labour ratio	SARB (2023)
AKR	Average output capital ratio	SARB (2023)
GD	Domestic government debt	SARB (2023)
GD ²	Domestic government debt squared	Calculated
tvp_elstcy_CAPB_tgr	Time-varying elasticity for total government revenue	Buthelezi and Nyatanga (2023)
tvp_elstcy_CAPB_g	Time-varying elasticity for government expenditure	Buthelezi and Nyatanga (2023)
tvp_elstcy_CAPB	Time-varying elasticity for both total government revenue and government expenditure	Buthelezi and Nyatanga (2023)

Data source: SARB (2023) and IMF (2020).

$$\Delta cnstnt_elstcy_CAPB_t = \sum_{j=1}^{4} TGR_t \left(\frac{y_t}{Y_t}\right)^{e_{tgr}} - G_t \left(\frac{y_t}{Y_t}\right)^{e_g}$$
(1)

Equation 1 is the cyclically adjusted primary balance (CAPB), where y is nominal GDP; Y is the growth of nominal potential of GDP, which is estimated based on the country-specific production functions; G is the government expenditure; TR is the aggregate tax revenue; and ε_r and ε_g are the elasticity for revenue and government expenditure, respectively. The CAPB reflects the reaction function of the fiscal authorities in response to government debt through increasing tax and government expenditure cuts. It is important to note that elasticity is given by ε_{tgr} and ε_g is the constant elasticity of government revenue as well as government expenditure. The time-varying elasticity is reflected in Equations 2–4.

$$\Delta tvp_elstcy_CAPB_tgr_t = \sum_{j=1}^{4} TGR_t \left(\frac{y_t}{Y_t}\right)^{\varepsilon_{tgr_t}}$$
(2)

$$\Delta tvp_elstcy_CAPB_g_t = G_t \left(\frac{y_t}{Y_t}\right)^{\varepsilon_{g_t}}$$
(3)

$$\Delta tvp_elstcy_CAPB_t = \sum_{j=1}^{4} TGR_t \left(\frac{y_t}{Y_t}\right)^{\varepsilon_{tgr_t}} - G_t \left(\frac{y_t}{Y_t}\right)^{\varepsilon_{g_t}}$$
(4)

In Equations 3 and 4, Buthelezi and Nyatanga (2023a) converted constant elasticity to timevarying elasticity, where $\varepsilon_{tgr} = \varepsilon_{tgr_t}$ and $\varepsilon_g = \varepsilon_{g_t}$ with the key distinction being the t time subscript reflecting the time-varying elasticity. In the study by Buthelezi and Nyatanga (2023b), we found that time-varying elasticity is accounted for, and fiscal consolidation episodes are found. There is a 56.26% variation in the CAPB with time-varying elasticity, and there is a 2.36% variation in the CAPB of the IMF data. As such the time-varying elasticity CAPB better capture fiscal consolidation.

The paper used the Cobb-Douglas production framework. This production function is used because it provided attractive fixtures of output which is key to the economic question of this paper. The estimation techniques used are threshold autoregressive regime and two-stage least squares (2SLS). The threshold autoregressive regime is effectively used to find the threshold (Hansen, 2000). The properties of the threshold autoregressive regime model are attractive as the empirical work of this study seeks to investigate whether there is a threshold of CAPB that can be attributed to fiscal consolidation. Moreover, it is given that the threshold autoregressive regime model allows for the effect beyond the threshold (Hansen, 2000). On the other hand, the two-stage least squares (2SLS) is used, because it is effective in solving the endogeneity which is the concern in the data used in the empirical work of this study. The 2SLS model is used as an alternative to the usual linear regression technique (ordinary least squares [OLS]), which is used when the right-hand side variables in the regression are correlated with the error term. 2SLS uses additional information to compute asymptotically unbiased coefficients (Wooldridge, 2010).

3.1. Theoretical framework Cobb-Douglas

The Cobb-Douglas production is used because it offers flexibility in the inclusion of other economic variables. The Cobb-Douglas production is given by Equation 5.

$$Y = AL^{\alpha - 1}K^{\alpha}$$

(5)

where Y is output, L is labour, K is capital, A is a positive constant, and α are constants between 0 and 1 (Mankiw, 2014). However, for this paper, the Cobb-Douglas production is extended with other economic variables of interest reflected in Equation 6.

$$GDP_t = AOLR_t + AOKR_t + CAPB_t \tag{6}$$

where $CAPB_t$ is the cyclically adjusted primary balance which proxies fiscal consolidation, and it can be disaggregated into the revenue and expenditure side of fiscal consolidation.

3.2. Model specification for the threshold autoregressive regime

The threshold autoregressive regime model of Hansen (1996, 2000) is presented in Equations 7 and 8.

$$y_t = \theta'_1 x_t + \epsilon_{1t} \text{ if } q_t \leq \gamma \tag{7}$$

$$y_t = \theta_2 x_t + \epsilon_{1t} \text{ if } q_t > \gamma \tag{8}$$

where y_t is the dependent variable, x_t is the independent variable, q_t is the threshold variable, \in_{1t} is the error term and γ is the threshold value. Equation 7 shows that the threshold variable is smaller than the threshold value. In Equation 8, the threshold variable is greater than the threshold value. The model assumes a dummy variable $I_t(\gamma) = q_t \leq \gamma$ and that is an indicator function. The dummy variable can also be presented as $q_t > \gamma$ then I = 1 or otherwise I = 0. If we let $x_t(\gamma) = x_t I_t(\gamma)$, this will result in rewriting Equations 7 and 8 as in Equation 9.

$$y_t = \theta'_1 x_t + \rho' x_t(\gamma) + \epsilon_{1t} \text{ and } \epsilon_{1t} \sim \text{iid0}, \sigma_t^2$$
(9)

where $\theta = \theta_2$, $\rho = \theta_1 - \theta_2$ and the error term \in_{1t}, \in_{2t} , where θ, ρ and γ are the parameters to be estimated. The parameters which arrive at the sum of squared errors are presented in Equation 10.

$$S_1(\gamma) = \hat{\epsilon}'_t(\gamma)' \hat{\epsilon}_t(\gamma)$$
(10)

The optimum threshold value is given by Equation 11.

$$\hat{\gamma} = \arg \min S_1 \gamma \tag{11}$$

The variance of residual is given by Equation 12.

$$\hat{\sigma}^2 = \frac{1}{T} \hat{\epsilon}'_t \hat{\epsilon}_t = \frac{1}{T} \mathsf{S}_1(\hat{\gamma}) \tag{12}$$

Once $\hat{\gamma}$ is obtained, the vectors of the slope coefficient to be estimated are $\hat{\vartheta} = \hat{\vartheta}(\hat{\gamma})$ and $\hat{\vartheta} = \hat{\vartheta}(\hat{\gamma})$. The theoretical framework that is outlined in Equations 5–8 is applied in the threshold autoregressive regime model outlined in Equations 7 and 8, as present in the estimation of Equations 13 and 14.

$$GDP_{t} = \begin{cases} \beta_{11}GD_{t-1} + \beta_{12}tvp_elstcy_CAPB\\ \beta_{21}GD_{t-1} + \beta_{22}tvp_elstcy_CAPB\\ \beta_{31}GD_{t-1} + \beta_{32}tvp_elstcy_CAPB + \in_{t}^{*} \end{cases}$$
(13)

$$GDP_t = \beta_1 + \beta_2 AOLR_t + \beta_3 AOKR_t + \beta_4 CAPB_t + \beta_5 X$$
(14)

where X reflect all the dummy variables, and the first-order condition is reflected in Equations 15 and 16.

$$\frac{\partial Y_{t}}{\partial L_{t}} = \begin{cases}
\beta_{11}(1-\alpha)\frac{Y_{t}}{(L_{t})} + \beta_{12}GD + \beta_{13}tvp_elstcy_CAPB \\
\beta_{21}(1-\alpha)\frac{Y_{t}}{(L_{t})} + \beta_{22}GD + \beta_{23}tvp_elstcy_CAPB \\
\beta_{31}(1-\alpha)\frac{Y_{t}(L_{t}) + \beta_{32}}{GD} + \beta_{33}tvp_elstcy_CAPB + \varepsilon_{t}^{*} \\
\frac{\partial Y_{t}}{\partial K_{t}} = \begin{cases}
\beta_{11}\alpha\left(\frac{Y_{t}}{(K_{t})}\right) + \beta_{12}GD + \beta_{13}tvp_elstcy_CAPB \\
\beta_{21}\alpha\left(\frac{Y_{t}}{(K_{t})}\right) + \beta_{22}GD + \beta_{32}tvp_elstcy_CAPB \\
\beta_{31}\alpha\left(\frac{Y_{t}}{(K_{t})}\right) + \beta_{32}GD + \beta_{33}tvp_elstcy_CAPB + \varepsilon_{t}^{*} \\
\end{cases}$$
(15)

3.3. Model specification two-stage least squares

The two-stage least squares (2SLS) method, which uses a single equation framework, is preferred when the data set is not that large as it is capable of successfully eliminating the degrees of freedom problem (Bollen, 1996). It is also an efficient estimator for reduced-form equations even in the presence of multicollinearity (Wooldridge, 2010). The 2SLS method may also be less sensitive to specification errors in the sense that those parts of the system that are correctly specified may not be affected appreciably by errors of specification in other parts (Wooldridge, 2010). The 2SLS model is reflected in Equation 17.

$$GDP_{t} = \beta_{1}K_{t} + \beta_{2}L_{t} + \beta_{3}GD + \beta_{4}GD^{2} + \beta_{5}tvp_elstcy_CAPB_{t} + \beta_{6\sum_{i},(X_intr_{i})}$$
(17)

where X_t is the vector of the variables considered in the model outline in Equation 13 and X_intr_t reflect the instrument variables. The empirical work of this study used the first-order derivative and equated it to 0 in the effort to find the minim or maxim point. The first-order condition is reflected in Equation 18.

$$\frac{\partial GDP_t}{\partial GD_t} = \frac{\beta_3}{2 * \beta_4 GD_t}$$
(18)

Endogeneity is also a concern in the data used, and in general, it is common in economic growth regression that some of the explanatory variables are endogenous. Statistically, endogeneity may be caused by simultaneous relations in variables (Wooldridge, 2010). In the context of this paper, endogeneity might be caused by causality running from *GDP* economic growth per person to *GD* domestic government debt or vice versa. The regression-based approach to detect endogeneity

Table 2. Descri	iptive statistics				
Variable	Obs	Mean	Std. Dev.	Min	Max
GDP	43	.255814	2.60926	-7.7	4.4
AOLR	43	394311.4	38075.04	331804	453484
AKR	44	177527.5	19037.5	149586	204700
GD	44	37.22682	11.20625	21.99	73.18
GD ²	44	1508.562	1027.835	483.5601	5355.313
tvp_elstcy_CAPB_tgr	44	-1.356591	12.22918	-47.3	49.72
tvp_elstcy_CAPB_g	44	5.259546	45.5113	-247.4	67.85
tvp_elstcy_CAPB	44	6.616136	56.26286	-297.13	115.1

within the variables is adopted in this study. The problem of endogeneity is that it may result in a rejection of type 1 errors, or biases when there is a need to reject the null hypothesis. The instruments in this study are found by using the large variables provided by a positive correlation with X_intr_t, X_t and GDP_t but negatively correlated with e_t . The rationale for finding the instrument is shown in Equation 19.

$$\begin{array}{rcccc} X_intr_t & \rightarrow & X_t & \rightarrow & \text{GDP}_t \\ & \uparrow & \swarrow & \\ & e_t \end{array} \tag{19}$$

4. Econometric results

Table 2 shows descriptive statistics of economic variables from the years 1979 to 2022 used in this study. In Table 2, the *GDP* gross domestic product is having a min rate of negative 7.7% and the maximum rate of 4.4%. The range of GDP growth rates is between -7.7% and 4.4%, which implies that the South African economy has experienced both periods of contraction and expansion during the period under study. The 4.4% is below the 5% advocated in the South Africa National Development Plan. The *AOLR* average capital-labour ratio is found to have a mean of 394 311.4. The level of *AOLR* average output labour ratio is found to have an average of 177,527.5 between 1979 and 2022. A higher capital-labour ratio indicates a more capital-intensive production process. In this study, the mean of the *AOLR* is 394,311.4, which suggests that the South African economy has relatively low labour productivity. The *GD* domestic government debt is found to have a mean of 37.22%. A higher level of government debt can be a burden on the economy, as it requires the government to pay interest on the debt, which can lead to higher taxes or cuts in government has a significant amount of debt.

The GD^2 square of domestic government debt is found to have a mean of 1508.56%. The fiscal consolidation variables have a rate of -1.35, 5.25 and 6.61% for $tvp_elstcy_CAPB_tgr$, $tvp_elstcy_CAPB_g$ and tvp_elstcy_CAPB , respectively. The GD^2 square of domestic government debt measures the nonlinear relationship between government debt and economic growth. A higher value indicates that the relationship between government debt and economic growth is not linear. In this paper, the mean of the GD^2 value of 1508.56% suggests that the relationship between government debt and economic growth is nonlinear. Fiscal consolidation measures the government's efforts to reduce its budget deficit and debt levels by cutting spending or increasing revenue. In this study, the $tvp_elstcy_CAPB_tgr$, $tvp_elstcy_CAPB_g$, and tvp_elstcy_CAPB variables measure the rate of fiscal consolidation. A positive rate indicates that the government is engaging in fiscal consolidation, while a negative rate indicates expansionary fiscal policy. The results of the paper suggest that the impact of fiscal consolidation on economic growth is nonlinear and varies depending on the level of government debt.

Table 3 shows a matrix of correlation among economic variables. The economic variable of interest considered has a positive relationship with the gross domestic product and the *tvp_elstcy_CAPB_tgr* is the only one that reflects the negative relationship with gross domestic product. The result suggests that with an increase in *AOLR*, there is an increase in the output per worker, which can lead to an increase in productivity and ultimately an increase in GDP. On the other hand, when there is an increase in *AKR* implies that there is an increase in GDP. The increase in *GD* implies that the government has borrowed more money to finance its expenditure, which can lead to an increase in economic activity and ultimately an increase in GDP. However, high levels of government debt can also have negative effects on economic growth if they lead to higher interest rates and crowd out private investment. If there is an increase in

Table 3. Matrix of	correlation							
Variables	GDP	AOLR	AKR	бD	GD ²	tvp_tgr	tvp_g	tvp_CAPB
GDP	1.00							
AOLR	0.25	1.00						
AKR	0.38	0.38	1.00					
GD	0.16	0.16	0.11	1.00				
GD ²	0.16	0.16	0.16	0.98	1.00			
tvp_elstcy_CAPB_tgr	-0.18	-0.18	-0.06	0.012	0.01	1.00		
tvp_elstcy_CAPB_g	0.12	0.12	0.18	0.10	0.12	-0.84	1.00	
tvp_elstcy_CAPB	0.13	0.13	0.16	0.08	60'0	06'0-	0.99	1.00
Note that the economi	c variable is the sam	e with different notation	on tvp_elstcy_CAPB_tgr =	= tvp_tgr, tvp_elstcy_CAPI	$a_{-}g = tvp_{-}g$ and $tvp_{-}elst$	$cy_{-}CAPB = tvp_{-}CAPB.$		

I able 4. Dickey		lips-Perron test	tor unit root						
			Dickey	-Fuller			Phillips-	-Perron	
Variables		Test	1%	5%	10%	Test	1%	5%	10%
GDP	Z(t)	-4.710	-3.634	-2.952	-2.610	-4.710	-3.634	-2.952	-2.610
d.AOLR	Z(t)	-3.639	-3.641	-2.955	-2.611	-3.639	-3.641	-2.955	-2.611
AKR	Z(t)	-4.093	-3.641	-2.955	-2.611	-4.093	-3.641	-2.955	-2.611
d.GD	Z(t)	-3.902	-3.634	-2.952	-2.610	-3.902	-3.634	-2.952	-2.610
d.GD ²	Z(t)	-4.211	-3.634	-2.952	-2.610	-4.211	-3.634	-2.952	-2.610
Estimated econon	nic variables								
tvp_elstcy_CAPB_tgr	Z(t)	-6.515	-3.634	-2.952	-2.610	-6.515	-3.634	-2.952	-2.610
tvp_elstcy_CAPB_g	Z(t)	-6.253	-3.648	-2.958	-2.612	-6.253	-3.648	-2.958	-2.612
tvp_elstcy_CAPB	Z(t)	-6.392	-3.634	-2.952	-2.610	-6.392	-3.634	-2.952	-2.610

	Jumber of Obs = 42.
3000	for $Z(t) = 0.0000$, N
- 11	approximate <i>p</i> -value
inp-cipicy-day	Notes: MacKinnon

Buthelezi & Nyatanga, *Cogent Economics & Finance* (2023), 11: 2261329 https://doi.org/10.1080/23322039.2023.2261329 GD², the result suggests that the effect of government debt on economic growth is not linear but instead has a curved relationship. This suggests that as government debt levels rise, the negative impact on economic growth becomes greater. The variable of interest noted when there is an increase in *tvp_elstcy_CAPB_g* this will increase GDP. An increase in *tvp_elstcy_CAPB* result implies that the government's revenue and expenditure are more responsive to changes in the economy, which can lead to an increase in GDP.

Table 4 shows the Dickey–Fuller and Phillips–Perron tests for unit root results. It is reflected that at the level the unit root null hypothesis is accepted for GDP, AKR, tvp_elstcy_CAPB_tgr, tvp_elstcy_CAPB_g, and tvp_elstcy_CAPB are stationary. Economic variables of d.AOLR, d.GD and d.GD² are stationary at first difference.

Table 5 reflects the econometric results to investigate the impact of the domestic government debt threshold on gross domestic product per person in the presence of fiscal consolidation as outlined in the theoretical framework as well as in the model specification section 3, particularly by Equation 9. Table 5, column 1, reflects that beyond 29.00% and 30.62% of the domestic government debt thresholds, the GDP gross domestic product will start to increase. However, beyond the thresholds of 29.00% and 30.62%, the presence of fiscal consolidation adopted through government expenditure cuts and tax increases, proxy by tvp_elstcy_capb the time-varying parameter elasticity cyclical adjusted primary balance results in a negative effect on gross domestic product per person. These results are statistically significant p-value of 5%. Therefore, a 1% increase in the sum of government expenditure cuts as well as a tax increase will result in a 0.158% decrease in gross domestic product holding all other factors constant. These results are not a consistent rationale for fiscal consolidation (Buthelezi, 2023a; Mankiw, 2019). As a policy, the result suggests that policymakers may need to carefully consider the trade-offs between government debt levels and the potential negative impacts of fiscal consolidation measures on economic growth. They may need to weigh the short-term benefits of reducing government debt through expenditure cuts and tax increases against the long-term costs of reduced economic growth. Furthermore, policymakers could also consider implementing measures to address the root causes of high government debt, such as reducing inefficient government spending, improving tax collection, and addressing corruption. This could lead to a sustainable reduction in government debt levels without the need for excessive fiscal consolidation measures that could harm economic growth.

Table 5, column 2, reflects that beyond 28.74% and 30.31% of the domestic government debt thresholds, the GDP gross domestic product will start to increase. The 28.74% and 30.31% of the domestic government debt thresholds increase GDP buttvp_elstcy_capb_tgr fiscal consolidation undertaken with tax hum GDP. The coefficient of tvp_elstcy_capb_tar is statistically significant p-value 5%, reflecting that for a 1% increase in tax, this will result in a 1.36 fall in the gross domestic product per person. Table 5, column 1, reflects that beyond 29.00% and 30.62% of the domestic government debt thresholds, the GDP gross domestic product will start to increase. Beyond the 29.00% and 30.62% of the domestic government debt thresholds, tvp_elstcy_capb_g fiscal consolidation achieved through government expenditure cuts will result in a negative impact on gross domestic product per person. The result reflects that tvp_elstcy_capb_g is statistically significant p-value 5%; therefore, a 1% increase in government expenditure cut will result in a 0.20% for in the gross domestic product per person. It proposes that when the domestic government debt exceeds these threshold levels, fiscal authorities should avoid fiscal consolidation measures that rely on tax increases or government expenditure cuts. Instead, policymakers should consider other measures to reduce government debt, such as increasing revenue through economic growth or reducing expenditures in non-essential areas. Moreover, the paper highlights the importance of considering the impact of fiscal consolidation measures on economic growth. The findings suggest that while fiscal consolidation measures can be effective in reducing government debt, they can also have negative consequences on economic growth. Policymakers should

Table 5. Threshold re	egression estimation		
Estimation	(1)	(2)	(3)
Region1	GDP	GDP	GDP
tvp_elstcy_capb	-0.158*		
	(-2.57)		
tvp_elstcy_capb_tgr		-1.364**	
		(-2.84)	
tvp_elstcy_capb_g			-0.201**
			(-2.86)
_cons	3.714***	0.807	3.839***
	(3.33)	(0.88)	(3.55)
Region2	GDP	GDP	GDP
tvp_elstcy_capb	-0.00173		
	(-0.24)		
tvp_elstcy_capb_tgr		0.00179	
		(0.06)	
tvp_elstcy_capb_g			-0.00332
			(-0.37)
_cons	-1.534	-2.080*	-1.553
	(-1.83)	(-2.51)	(-1.88)
Region3	GDP	GDP	GDP
tvp_elstcy_capb	0.00638		
	(0.44)		
tvp_elstcy_capb_tgr		-0.0658	
		(-1.19)	
tvp_elstcy_capb_g			0.00535
			(0.31)
_cons	0.207	0.166	0.219
	(0.42)	(0.39)	(0.45)
Threshold	1	2	3
gd_thr_1	29.000	28.7400	29.0000
gd_thr_2	30.620	30.3100	30.6200
Statistics	1	2	3
odr_1ssr	222.9307	205.9457	215.9071
odr_2ssr	202.2691	169.9869	195.2831
Ν	42	42	42

Notes: *t* Statistics are in parentheses. **p* < 0.05, ***p* < 0.01, ****p* < 0.001.

carefully consider the trade-off between reducing government debt and promoting economic growth when implementing fiscal consolidation measures.

Table 6 reflects economic results that analyze different thresholds of domestic government debt using the dummy variable in the presence of fiscal consolidation. The results are in line with the application of the methodology outlined in Equation 12. Table 6 presents the result of the presence of fiscal consolidation achieved with the use of both the government expenditure cut and tax increase and this is proxied by *tvp_elstcy_capb*. In Table 6, column 1, the threshold of *dummy_gd_30,30%* domestic government debt has a negative impact on the gross domestic product per person. Such results are consistent with the classical school of thought which

Ectimation	(1)	(2)	(3)	(7)	(E)	(6)
Escillation	(+)	(2)	(1)	(+)		2
Variables	GDP	GDP	GDP	GDP	GDP	GDP
AOLR	-0.000254***	-0.000257***	-0.000273***	-0.000249***	-0.000294***	-0.000228***
	(-6.72)	(-16.28)	(-9.05)	(-5.85)	(-10.56)	(-9.53)
AKR	0.000289***	0.000307***	0.000316***	0.000270***	0.000341***	0.000267***
	(6.43)	(13.80)	(9.42)	(5.22)	(6.89)	(8.00)
GD	0.341***	0.455***	0.441***	0.377***	0.397***	0.358***
	(8.58)	(11.09)	(6.76)	(4.88)	(8.41)	(6.17)
tvp_elstcy_capb	-0.127***	-0.0870***	-0.0944***	-0.124**	-0.101**	-0.0874***
	(-3.29)	(-3.55)	(-3.31)	(-3.14)	(-2.97)	(-3.49)
dmmy_gd_30	-1.144					
	(-1.09)					
dmmy_gd_50		4.052***				
		(3.85)				
dmmy_gd_70			3.299			
			(1.66)			
dmmy_gd_30_40				-0.516		
				(-0.85)		
dmmy_gd_40_50					3.081***	
					(4.59)	
dmmy_gd_50_60						-2.855**
						(-2.82)
cons	30.48***	20.13***	25.31***	30.72***	32.48***	24.22***
	(4.48)	(7.93)	(5.69)	(5.11)	(7.36)	(8.03)
Z	26	26	26	27	27	26

advocates that government debt is detrimental to economic growth (Mankiw, 2014, 2020). Despite this, South Africa has the PFMA Act which outlines the government management of funds. The results suggest that lower domestic government debt weakens gross domestic product per person. Therefore, the country must do an introspection on how it can manage domestic government debt and improve financial management as well as plan to recover the negative impact of domestic government debt on gross domestic product per person. However, in line with Alesina et al. (1998), tvp_elstcy_capb fiscal consolidation is found to have a slightly positive impact on the gross domestic product reflected in the coefficient value of 0.009. However, the value is statistically insignificant; therefore, we can't tell how much the magnitude of the fiscal consolidation at this stand will be apart from the direction of the positive impact. The threshold of dummy_ad_50, 50% of domestic government debt in Table 6, column 2, is found to have a positive impact on the gross domestic product per person. The threshold of 50% is statistically significant at a p-value of 1% with a coefficient value of 4.05%. These results suggest that there is a 4.05% chance that the gross domestic product per person will increase at the threshold of 50% of government debt. Similarly, fiscal consolidation undertaken with the use of government expenditure cuts as well as a tax increase at the threshold of 50% of domestic government debt is found to have a positive impact on the gross domestic product per person.

However, the coefficient of fiscal consolidation is found, to be statistically insignificant as such, and the magnitude of fiscal consolidation is not clear. At the accumulated threshold of *dummy_gd_70*, 70% of the domestic government debt in Table 6, column 3, is found to have a positive impact on the gross domestic product per person. Moreover, physical consolidation is found to result in a positive impact on the gross domestic government debt applied with the utilization of the dummy variables in Table 6 from columns 1 to 3 provides evidence of a U-shape, which is mostly advocated by Checherita-Westphal and Rother (2012). Such evidence outlines that domestic product per person in the presence of effective fiscal consolidation. These results are also suggestive that the contraction expansionary fiscal policy outlined by Alesina and Perotti (1995), Alesina and Ardagna (2010) and Romer and Romer (2010) amongst others is evident in South Africa.

The cumulative range of thresholds of domestic government debt is reflected in Table 6 with the rate range from 30% to 40%, 40% to 50% and 50% to 60%, respectively, from columns 4 to 6 in the presence of fiscal consolidation achieved through government expenditure cuts as well as a tax increase. In column 4 of Table 6, the accumulative threshold between dummy_gd_30_40, 30% and 40% are found to have a negative impact on the gross domestic product per person. On the other hand, the tvp_elstcy_capb fiscal consolidation undertaken through government expenditure cuts and tax increases is found to have accommodated this range with a positive impact on gross domestic product person. However, the magnitude impact is not detected given that the results are statistically insignificant, as such the empirical work deals with the direction of the positive impact on GD coming from tvp_elstcy_capb. Table 6, column 5, reflects the cumulative threshold range of domestic government debt between dummy_gd_40_50 40% and 50% in the presence of tvp_elstcy_capb fiscal consolidation achieved through government expenditure cuts as well as tax increases. The cumulative threshold range of domestic government debt between dummy_qd_40_50 is found to be statistically significant at the p-value of 10% with the coefficient value of 3.081, while on the other hand, tvp_elstcy_capb fiscal consolidation is found to be statistically significant at 5% p-value with the coefficient value of 0.0178. Moreover, in the presence of tvp_elstcy_capb fiscal consolidation a 1% increase in both government expenditure cuts, and the tax increase will result in a 0.0178% increase in the gross domestic product per person.

Given the results, there is a need for fiscal authorities should need to strengthen tax policies: Policymakers could consider strengthening tax policies, such as closing tax loopholes, increasing tax rates on high-income earners, and broadening the tax base to increase government revenue. On the other hand, policymakers could consider improving the efficiency of government spending to reduce wasteful spending and increase the effectiveness of public programs. This could include measures such as implementing performance-based budgeting, reducing bureaucratic red tape, and promoting transparency and accountability in government spending. Policymakers should consider policies that encourage private sector investment, such as reducing regulations that stifle business growth, providing tax incentives for investment in certain sectors, and investing in infrastructure that benefits businesses.

Column 5 of Table 6 reflects the cumulative threshold range of domestic government debt between dummy_gd_50_60, 50% to 60% in the presence of tvp_elstcy_capb fiscal consolidation achieved through government expenditure cuts as well as tax increases. The dummy_gd_50_60 is found to be statistically significant at the p-value of 5% with a negative coefficient of 2.855, on the other hand, tvp_elstcy_capb is fiscal consolidation is found to be statistically insignificant. These results suggest that the accumulation thresholds of domestic government debts between 50% and 60% result in a 2.85% chance of a reduction in the gross domestic product per person, while fiscal consolidation provides the accommodative policy to increase gross domestic product per person with a magnitude not ascertained statistically. Table 6, columns 4-6 of the cumulative threshold range of domestic government debt between ranges, reflects a flat S-shape clockwise impact on gross domestic product per person. These results suggest that a lower range of domestic government debt thresholds has a detrimental effect on gross domestic product per person. However, mid-range domestic government debt has a positive impact on gross domestic product per person. Last, the high range has a negative impact on the gross domestic product. Nevertheless, fiscal consolidation provides evidence of stimulating the gross domestic product per person across all ranges of the threshold of domestic government debt.

Table 7 shows the summary of results in all estimations done in the empirical work of this study. Table 7 shows that in state 1, the accumulative domestic government debt threshold of 30%, 50%

Table 7. Threshold do	mestic government deb	t, GDP and fiscal consoli	dation
Estimation	1	2	3
Economic variables	GDP	GDP	GDP
AOLR	-0.000282***	-0.000262***	-0.000284***
	(-6.82)	(-6.64)	(-6.81)
AKR	0.000312***	0.000285***	0.000316***
	(6.16)	(5.74)	(6.28)
GD	0.806***	0.668***	0.813***
	(3.86)	(3.85)	(3.71)
GD ²	-0.00439*	-0.00314*	-0.00440*
	(-2.47)	(-2.30)	(-2.33)
tvp_elstcy_capb	0.0192		
	(1.36)		
tvp_elstcy_capb_tgr		-0.128***	
		(-3.35)	
tvp_elstcy_capb_g			0.0184
			(0.99)
_cons	25.72***	26.54***	25.53***
	(5.85)	(6.57)	(5.86)
N	27	27	27

Notes: *t* Statistics in parentheses. **p* < 0.05, ***p* < 0.01, ****p* < 0.001.

70% in the presence of tvp_elstcy_capb fiscal consolidation of using both government expenditure cuts and tax increase has a negative, positive, and positive impact on gross domestic product per person in the respective thresholds. A similar result is found in states 2 and 3, with accumulative domestic government debt thresholds of 30%, 50%, and 70% in the presence of tvp_elstcy_capb_tgr fiscal government expenditure revenue only and tvp_elstcy_capb_g fiscal government expenditure cuts only have a negative, positive, and positive impact on gross domestic product per person in the respective thresholds. The overall impact is a U-shape reflecting that as the threshold increases this fiscal consolidation will reduce domestic government debt and eventually result in an increase in domestic government debt at a high level of domestic government debt threshold. If fiscal consolidation is undertaken with the use of both government expenditure cut and tax increase tvp_elstcy_capb and fiscal consolidation are undertaken government expenditure cuts only tvp_elstcy_capb_g are found to have a negative, positive and negative impact on domestic government debt respectively in the rage threshold of 30-40%, 40-50% and 50-60%. Fiscal consolidation undertaken with tax increase only is found to have a positive, positive, and negative impact on domestic government debt respectively in the range threshold of 30-40%, 40-50%, and 50–60%. Overall fiscal consolidation is found to have a flat clockwise S shape impact on domestic government debt when the range threshold is considered.

Fiscal consolidation policies that include both government expenditure cuts and tax increases, as well as those that focus on government expenditure cuts only, have a negative impact on domestic government debt at lower thresholds, a positive impact at intermediate thresholds, and a negative impact at higher thresholds. In contrast, fiscal consolidation policies that involve tax increases only have a positive impact on domestic government debt at lower and intermediate thresholds, but a negative impact at higher thresholds. Overall, the impact of fiscal consolidation on domestic government debt is found to be a flat clockwise S shape when the range threshold is taken into account. The policy implications of these findings are that fiscal consolidation policies can have both positive and negative impacts on GDP per person and domestic government debt, depending on the level of government debt and the specific policy measures adopted. Therefore, policymakers need to carefully consider the state of the economy and the level of government debt when designing and implementing fiscal consolidation policies. They may need to consider a mix of policies, including both government expenditure cuts and tax increases, to achieve a balance between reducing debt levels and maintaining economic growth. Additionally, policymakers should consider the potential distributional impacts of these policies on different groups of society, such as low-income households, and implement measures to mitigate any negative effects.

5. Conclusion

The empirical work of this study investigates the threshold impact of government debt on economic growth (peroxide by gross domestic product per person) in the presence of fiscal consolidation in South Africa. This empirical work used economic data from 1979 to 2022. The empirical work seeks to fill the gap in the identification of the threshold of domestic government debt on economic growth in the presence of fiscal consolidation. The autoregressive threshold regime (TAR) model and two-stage least squares (2SLS) are used. The economic variables used are the average output-labour ratio, average capital-labour ratio, cyclically adjusted primary balance, domestic government debt, the square of domestic government debt, and gross domestic product per person. The TAR provides evidence that the domestic threshold of 30.62% 30.31% and 30.62% results in an increase in the gross domestic product per person. Fiscal consolidation is achieved using both government expenditure cuts and tax increases which have a positive impact on gross domestic product per person at the threshold of 30.62%. Fiscal consolidation is achieved using both government expenditure cuts which have a negative impact on the gross domestic product when the threshold is 30.31%. At the threshold of 30.31% fiscal through government, expenditure cut has a positive impact.

The potential economic effect is that economic variables such as output-labour ratio, capital-labour ratio, primary balance, government debt, and GDP per person suggest that this study is attempting to analyze the impact of fiscal consolidation on economic growth. The paper finds evidence of a domestic threshold at which fiscal consolidation through government expenditure cuts and tax increases has a positive impact on GDP per person. However, the paper also suggests that fiscal consolidation through government expenditure cuts alone can have a negative impact on GDP per person when the threshold is lower. The policy implication is that as fiscal authorities seek to achieve fiscal consolidation and promote economic growth should carefully consider the threshold at which such policies have a positive impact on GDP per person. Governments should focus on achieving a balance between government expenditure cuts and tax increases, especially when the domestic threshold is high. Additionally, governments should be cautious when pursuing fiscal consolidation policies through government expenditure cuts alone, as this can have negative effects on economic growth when the domestic threshold is low. It is recommended that policymakers should consider the unique economic conditions of their country when designing fiscal consolidation policies. Governments should consider implementing a combination of expenditure cuts and tax increases to achieve fiscal consolidation, especially when the domestic threshold is high. Policymakers should be aware of the potential negative impact on economic growth when pursuing fiscal consolidation policies through expenditure cuts alone, particularly when the domestic threshold is low. They should carefully monitor the impact of such policies and adjust them as necessary.

The 2SLS results are that the accumulative domestic government debt threshold of 30%, 50% and 70% in the presence of fiscal consolidation using both the government expenditure cut and increase in tax have negative, positive, and positive impacts respectively on gross domestic product per person. A similar result is found when fiscal consolidation on government expenditure cuts only and tax increases only. The range threshold of domestic government debt between 30% and 40% is found to have a negative impact on gross domestic product per person in the presence of fiscal consolidation and the use of both government expenditure cuts and tax increases simultaneously. However, when fiscal consolidation is achieved through tax increase only, the results reflect a positive impact on gross domestic gross product per person. Consistent with the work of Reinhart and Rogoff (2010). The TAR provides evidence that the domestic threshold of 30.62% 30.31%, and 30.62% results in an increase in the gross domestic product per person. Fiscal consolidation is achieved using both government expenditure cuts as well as tax increases which has a positive impact on gross domestic product per person at the threshold of 30.62%. Fiscal consolidation is achieved using both government expenditure cuts which has a negative impact on the gross domestic product when the threshold is 30.31%. At the threshold of 30.31% fiscal through government, expenditure cut has a positive impact. The 2SLS results are that the accumulative domestic government debt threshold of 30%, 50% and 70% in the presence of fiscal consolidation using both the government expenditure cut and increase in tax have negative, positive, and positive impacts respectively on gross domestic product per person. A similar result is found when fiscal consolidation on government expenditure cuts only and tax increases only. The range threshold of domestic government debt between 30% and 40% is found to have a negative impact on gross domestic product per person in the presence of fiscal consolidation and the use of both government expenditure cuts and tax increases simultaneously. However, when fiscal consolidation is achieved through tax increase only, the results reflect a positive impact on gross domestic gross product per person.

Given the result, the economic effect in this paper is that the impact of domestic government debt on the gross domestic product (GDP) per person depends on the level of fiscal consolidation and the debt threshold. The results suggest that a high level of domestic government debt can have a negative impact on GDP per person, but the impact varies depending on the level of fiscal consolidation and the debt threshold. The paper also finds that fiscal consolidation achieved through tax increases alone has a positive impact on GDP per person, while government expenditure cuts alone have a negative impact on GDP per person when the debt threshold is low. The policy implications are that policymakers should carefully consider the impact of domestic government debt on economic growth and the appropriate level of fiscal consolidation needed to address the debt. The results suggest that a balance between government expenditure cuts and tax increases may be necessary to achieve fiscal consolidation without negatively impacting economic growth. Policymakers should also be aware of the potential negative impact on economic growth when pursuing fiscal consolidation policies through expenditure cuts alone, particularly when the debt threshold is low. It is recommended that policymakers should focus on achieving a balance between government expenditure cuts and tax increases to achieve fiscal consolidation while promoting economic growth. Governments should be cautious when pursuing fiscal consolidation policies through expenditure cuts alone, particularly when the debt threshold is low. Policymakers should carefully monitor the impact of fiscal consolidation policies on economic growth and adjust them as necessary based on the results of the analysis.

Author details

Eugene M. Buthelezi¹ ORCID ID: http://orcid.org/0000-0002-2233-7347 Phocenah Nyatanga¹ E-mail: msizi1106@gmail.com ORCID ID: http://orcid.org/0000-0002-7128-5133

¹ Department of Economic and Finance, University of KwaZulu-Natal, Pietermaritzburg, South Africa.

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